bound to stay and to increase in number and in extent of the facilities they afford. Already there are about a dozen permanent laboratories located upon our two coasts, while there are several more upon our inland waters. But it is in Europe that these stations have their greatest development, and it is of these that Dr. Kofoid has given a most valuable account.

The arrangement of his book is geographical and quite naturally begins with the celebrated Stazione Zoologica of Naples, despite the fact that the station at Concarneau (France) was the first permanent laboratory to be located on the shore (1859). Then follow, in order, the laboratories of France, Great Britain, Germany, Austria-Hungary, Scandinavia, Holland, Belgium, Spain, Finland, Russia and Bulgaria. Of each a history is given, usually illustrated with photographs and plans, of great value to all who have to do with the planning, equipment and management of biological stations in any part of the world. The volume will also be of great use to those who wish to avail themselves of the facilities of these stations, for it gives lists of the officials, conditions on which workers are admitted, lists of instruments and apparatus available, extent of libraries, and states whether price lists of specimens for sale are issued.

Especially valuable to all who have to do with laboratories, whether of biological stations or of our high schools and colleges, are the notes upon aquaria and the different methods of their construction, the pumps, tubing, valves and tanks of the water supply, and the different methods of aerating water and the rearing of larvæ and other forms. Thus we are told the composition of the Naples aquarium cement (equal parts of whiting and red lead, made into a stiff putty with boiled linseed oil) and the value of the "mastic de Cette," used for the same purpose.

In connection with many of the stations a statement is made of the annual expenditure within recent years, from which we learn that the running expenses of the Naples station are about $40,000; Helgoland, $18,000; Plymouth, $15,000; the Helder, $10,000, and so on down to Concarneau and Bergen with a budget of $1,500 each and Port Erin and Wimereux with a little over $1,000. Others probably have even less.

In all about eighty marine and fresh-water stations are described, many of them from personal knowledge on the part of Dr. Kofoid, and others from the publications. Besides there are accounts of other institutions which are not laboratories of the same type, but, like the Challenger office, are connected with the investigation of marine life and other problems of oceanography, or like the various fisheries bureaus, are concerned with economic problems. A good bibliography, to which references are made in the text, concludes the volume. J. S. K.

Charts of the Atmosphere. By ABBOTT LAWRENCE ROTCH and ANDREW H. PALMER. New York, John Wiley & Sons. 1911. Oblong 4to, cloth.

More than half a century ago Lieutenant Maury, of the United States Navy, rendered an invaluable service to mariners by his extended observations of ocean currents. The work which he began is still being carried on, with the result that from year to year new knowledge is gained concerning those aids and hindrances to navigation.

We now have in aerial research something analogous to the marine work of Maury.

In 1885, Abbott Lawrence Rotch—now professor of meteorology in Harvard University—founded the Blue Hill Meteorological Observatory. This is situated on the summit of a hill a few miles south of Boston and is 625 feet above sea level. The summit is less than eight miles from the coast line and is the highest elevation, so situated, between Maine and Florida. The observatory is a prominent feature in the landscape and may be seen eastward from Providence-Boston trains about fifteen minutes before reaching the latter city.

From the time of the foundation to the present, meteorological phenomena have there been continuously observed and recorded. The work still goes on.

From the beginning Professor Rotch realized that the elusive problems which ever con-

front meteorologists can only be solved by observations of the higher air.

In the early nineties the work of measuring the heights and velocities of clouds was begun. In 1894 the first systematic use of kites for carrying self-recording instruments to great heights was inaugurated at Blue Hill and in more recent years, under the auspices of the observatory, exploring balloons carrying instruments only have added much to the knowledge of the conditions which prevail above us.

In the earlier years of research at Blue Hill, the achievement of dynamic flight seemed to be in the dim and distant future, yet it was safe to assume that it would come in time and that when it came the aerial ocean must be charted.

We find a noble beginning of this new science in a recently published work, "Charts of the Atmosphere," written by Professor Rotch in collaboration with Mr. Andrew H. Palmer, one of his assistants at the observatory.

The charts are twenty-four in number, each being accompanied by full and clear descriptive text. The list is here given:

CHARTS

1. Relative Heights, Atmospheric Density and Temperature.
2. Average Temperature, Barometric Pressure, Wind-velocity and Pressure up to 30,000 Feet.
3. Maximum Wind-velocities and Pressure up to 30,000 Feet at Blue Hill.
4. Wind-pressures for Constant Velocities up to 30,000 Feet.
5. Wind-pressures for Constant Velocities up to 10,000 Feet.
6. Monthly Temperatures up to 12,000 Feet at Blue Hill.
7. Monthly Wind-velocities up to 12,000 Feet at Blue Hill.
8. Hourly Wind-velocities up to 10,000 Feet at Blue Hill.
9. Frequency of Constant Wind-velocities, 1,000 to 10,000 Feet at Blue Hill.
10. Frequency of Winds at Blue Hill, 650 Feet.
11. Velocity of Winds at Blue Hill, 650 Feet.
12. Frequency of Winds at Blue Hill, 1,650 Feet.
13. Velocity of Winds at Blue Hill, 1,650 Feet.
14. Frequency of Winds at Blue Hill, 3,300 Feet.
15. Velocity of Winds at Blue Hill, 3,300 Feet.
16. Frequency of Winds at Blue Hill, 6,600 Feet.
17. Velocity of Winds at Blue Hill, 6,600 Feet.
18. Frequency of Winds at Blue Hill, 10,000 Feet.
19. Velocity of Winds at Blue Hill, 10,000 Feet.
20. Wind-velocity and Direction up to 13,000 Feet at St. Louis.
21. Winds at Various Heights as Related to Barometric Pressure at the Ground.
22. Frequency of Winds in the N. E. Trade Region of the Atlantic Ocean.
23. Velocity of Winds in the N. E. Trade Region of the Atlantic Ocean.
24. Aerial Routes in Summer across the North Atlantic Ocean.

The author writes in the introduction: "The charts, which are believed to be the first of the kind adapted to the use of airmen, relate only to portions of the United States and the Atlantic Ocean, but they will doubtless be perfected by aerologists and extended in the near future to other parts of the globe."

Man ever seeks new lines of research and new regions to explore. So fascinating is the quest that it seems certain that Professor Rotch's expectations will be realized and that this work will be carried on by others in all parts of the world.

Even a brief study of this book of charts makes it clear that the work is the result of long-continued thought and of great labor. The various schemes of charting are brilliantly ingenious and original. It should be understood that these charts deal with the average conditions and not the actual ones which have to be faced on any given day.

The charts enable the aviator or aeronaut to foresee approximately the wind and temperature conditions that he will encounter aloft at any season of the year. With their aid the aviator may learn to what altitude he may safely ascend in regard both to his motor and to his bodily comfort, what winds are the prevailing ones for cross-country flight and at what levels they may be found.

The aeronaut may plan his journey from the wind charts, and in connection with a daily weather map go at will on either a long or a short excursion. Indeed, near the coast, it is shown that a free balloon may travel a

considerable distance inland on the sea-breezes and return with the opposite upper current to the coast within a few hours. For long balloon voyages, either trans-continental or trans-Atlantic, the charts are invaluable, showing, as they do, the level which the balloon should seek in order to obtain the benefit of the most favorable winds in respect to both direction and velocity, while other tables indicate the effects upon the passengers and upon the gas and motors.

The author does not mean to intimate that it is his belief that such balloon voyages will ever be of utilitarian value, but it does seem to him probable that the voyages would bring valuable data to the science of meteorology.

The reviewer would bespeak for Rotch and Palmer's method the most careful consideration of those engaged in this research work. There is a danger ahead. It is that in the strong and justifiable desire to be original the workers may follow diverse methods, making comparison and coordination of results extremely difficult, if not impossible, and thus labor may be wasted.

This is the day of "team-work," and only by such work can the aerial ocean be charted.

JAMES MEANS

Principles of Physics. By W. F. MAGIE, of Princeton University. New York, The Century Co. 1911.

Within the past four months as many new college text-books in physics have appeared as in the preceding four years. New books by Carhart, whose earlier texts have had such wide success, by Magie of Princeton, Kimball of Amherst, Reed and Guthe of Michigan, and Hurst and Lattey of Oxford, Eng., added to the several good books already available, give college instructors a much wider range of choice for a suitable text for class use than they have had for many years.

Perhaps the most unique and original of the new offerings is that by Professor Magie, of Princeton University. Doubtless many teachers have felt that our common texts make too scant use of the historical development of physics in their presentation of its principles. The connection of related topics is often best brought out by showing how the emphasis of one in the scientific thought of a certain period, has led to discoveries in the other field. After reading such a book as Mach's "Mechanics" I have often longed for a text in general physics enriched with more of the historic evolution and the philosophy of the subject. But perhaps few of us would go as far as the author of this book does when he takes as a general principle "the progress of discovery has been along the line of least intellectual resistance and it is probable that what was easiest to discover once will now be the easiest to understand." This seems to assume that the attitude of mind of the pioneer in discovery is much like that of the student seeking to grasp the principles of a new science. But the one has the knowledge of what has been done in his branch of science to suggest further advance, the other must get his grasp on the new truth rather by relating it somehow to the facts of his own limited experience, else it will all seem unreal and bookish to him. The sophomore is not a scholar; he is little more than a boy and it is doubtful if the line of historic development will in every case give the best view-point for him. For a mature student or one who is seeking by a review of the subject to strengthen the foundations after a too hasty course in physics this book will be most suggestive, even inspiring. Professor Magie's method of treatment brings one into close relationship with the master minds who have given direction to the larger movements in scientific thought and such relationship is inevitably stimulating.

This historical point of view determines perhaps the unusually large proportion of the book devoted to mechanics and the properties of matter. This amounts to about 39 per cent. of the book. (The proportion found in four other recent texts by American authors averages 24 per cent.)

The use of the historical method doubtless explains also the relatively small attention given to the illustration of physical principles from modern machinery and industrial processes. To devote but a half page (p. 486) to